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AGRICULTURAL MEMORANDUM NO 570

Comparison of glasshouse crop water requirements derived from sunshine and solarimeter records at Efford Experimental Horticulture Station.

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During the summer months we issue as routine weekly values of potential transpiration derived using the method of Technical Bulletin No 16 which involves a correction based on measurements of the hours of bright sunshine. These figures are given to ADAS horticultural advisers to enable them to advise growers on the irrigation water requirements of glasshouse crops, especially tomatoes. Some Experimental Horticultural Stations, Efford and Lea Valley for example, base their watering requirements on solar radiation measurements made with Kipp solarimeters. Several horticulturists have queried the validity of applying the methods of Technical Bulletin No 16 which specifically refers to the transpiration of a full cover green crop in the open to a crop in a greenhouse.

In the course of a separate investigation Efford EHS supplied weekly totals of sunshine together with the corresponding weekly totals of solar radiation measured with a Kipp solarimeter (mounted in the open) for the 5-year period 1957-1961 inclusive.

The sunshine figures were used to deduce the average weekly potential transpiration during each of the 6 months April to September for the 5-year period using the method of Technical Bulletin No 16. Following Efford practice the weekly solar radiation totals in Cal/cm² were converted to "potential solar evaporation" in inches of water by dividing by the product of the metric to inch conversion, 2.54, and the latent heat of evaporation of water at 20°C, 585. This assumes that all the incoming solar energy is used for evaporation from the plant and none for heating, a utilisation factor of 70% is applied to apportion the incoming energy between the two processes, ie 70% for evaporation and 30% for heating. If the solarimeter were in the greenhouse this would then be the irrigation need, however in this case the figures were derived from a solarimeter in the open and a further correction must be made for the transmission through the walls and roof of the greenhouse.

Efford supplied figures for the average monthly transmission of the greenhouse derived from a comparison between readings of Kipp solarimeters mounted inside and outside the house over a 13-year period 1957-1969. The values are tabulated and show a small variation through the summer with the highest values in June and July.

The average weekly values for the irrigation need of the crop are tabulated below:

Month	Glasshouse transmission	Water requirement (in. per week) derived from:	
		a) Solarimeter	b) Sunshine (PT)
April	60.2%	0.67	0.55
May	62.9%	0.73	0.68
June	64.8%	1.06	1.00
July	64.5%	0.97	0.91
August	61.8%	0.73	0.77
September	60.4%	0.54	0.49

As can be seen the values derived from records of bright sunshine, although for 5 of the 6 summer months consistently lower than those derived from solar radiation measurements, are not grossly different and it is suggested that the discrepancy of nearly 0.02 in. per day in April and less than 0.01 in. per day for the other months amounts to less than the accuracy with which a grower can measure the water applied. It is also likely that the transmission figures which apply to a greenhouse at Efford will vary for different greenhouses and also orientation of greenhouses on different sites and it is very encouraging to find that the figures we derive and issue show such close agreement with those derived from solar radiation measurements.

It is to be noted that measurements of bright sunshine using a Campbell-Stokes sunshine recorder are made much more commonly and indeed are much simpler and cheaper to make with acceptable accuracy than measurements of solar radiation using a Kipp solarimeter. To maintain a record of solar radiation of acceptable accuracy requires a great deal of effort and is expensive.

My thanks are due to the staff at Efford EHS who extracted and supplied the data on which this comparison is based.

Any comments or suggestions on this paper should be sent to the author.

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